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Fishues is a new column featuring information on every aspect of diets for animals in zoos and aquariums. This column will be a contributing feature, much like Enriching Environments and Trainer's Forum. Initiating the column both in concept and with the first series of contributions is Dan Shinder, who, for the past several years has established and maintained the fish procurement program for the US Navy's marine mammals. Dan will also be compiling the column in the future.

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This article on production methodologies will be the first in a series addressing some of the "fishues" that concerns each of us. After all, the food we feed our animals is central to our quality of care. Seafood, being the highly perishable product that it is, demands that certain sanitary standards and protocols be followed to ensure the highest nutritional value and minimize the possibility of bacteriological or toxic contamination. Unfortunately, we cannot assume that these practices are always carried out to the extent we would desire. Except for those instances when pollution, red tide, or other toxic microbial activity affect the quality of our fish, it is perfect when it comes out of the ocean. Many things can happen to the fish between the time it is caught and frozen to deteriorate the quality whether we can see it or not. The harvesters and processors can directly control many of these factors. Even more so, we, the end users should exert our influence by demanding that certain standards and methods of processing and handling be followed.

The first thing that must be addressed is the perception of those involved as to what the product is used for. "Bait fish" or "zoo food" are terms I hear that seem to differentiate between those products used for "human consumption". Bait herring, for example, is used extensively in the crabbing industry to bait the traps. Who really cares if this product sits in a container overnight at room temperature before being processed? The crabs don't seem to mind; in fact, the worse it smells the better. True, processors or importers sometimes get a price break in the duties and tariffs they pay when the product is classified as bait fish or animal food. Unfortunately, the whole production mentality from the fishermen to the people who off-load from the boats to the packing and production people on the line at the processing facilities is affected. I don't use those terms in my conversations with processors or fishermen. I like to make sure that they know this product is to feed marine mammals and that human consumption standards are a *minimum*. I work directly with the plant manager or Quality Assurance manager to brief all personnel involved during production. Line personnel who do the boxing prior to freezing are often minimum wage employees. Their work is rather mundane and repetitious. Yet when they know this product is going to feed dolphins and whales at their favorite marine park or oceanarium, they take a more conscientious attitude. Especially when the inspector (me) is standing over their shoulder.

The QA manager typically keeps a statistics sheet on the particular species being processed. We sit down together and design a specification sheet that states the vessel that caught the fish, where it was caught, the time of catch and off-loading, production starts time, and the time the first and last boxes are placed in the freezer. A lot number is assigned for tracking purposes. The goal here is to "**minimize the time from catch to freezing**". I also like to know how the fish was harvested. Was it a purse seine boat or a factory trawler? If a seiner, what is the hold capacity of the boat and how many tons was loaded? The tighter the fish is packed, the more difficult it is to circulate water and bring down the temperature. You will want to know if their fish hold is iced, has a champagne system, or a Refrigerated Seawater System (RSW)? Of the three methods, iced is probably the least preferable as uneven temperatures can occur throughout the hold. If a champagne system is used with the ice, it will provide circulation of the water by a series of plastic pipes in the bottom of the hold with holes drilled in that bubbles air through the hold thereby more evenly distributing the temperature. RSW is seawater that passes through a

chiller that can bring the temperature of the hold down to a specific setting – typically 30 degrees (F) or -1 degree (C). The chilled water is circulated throughout the hold and allows for uniform temperature of the fish. My preference is RSW. The water in the hold should also be pre chilled prior to fish being pumped in. The colder. the faster, the better. If a trawler, was the product Frozen At Sea (FAS)? This can often be the best product as long as the vessel is a modern one with state-of-the-art equipment. This method is rare for the species we use although I have seen North Sea Atlantic capelin and Indian Ocean mackerel produced this way.

When the catch vessel arrives at the processing plant, the fish should be pumped from the hold as soon as possible and placed in sanitized plastic containers. The container should be filled with chilled brine water and covered with ice to keep the core temperature down. Some species of fish are graded at this point for size or separated by sex. This process adds considerable handling to the fish and increases the production effort (time/cost).

In the case of capelin, the females are almost always separated out for the Japanese roe market, which brings in a lot more money per pound than the males. And which do you think gets priority in processing? The low money yielding males or the high priced females with roe? I prefer an ungraded product before the roe is fully developed. It is one less step in the processing, reduces the time from catch to freezing, the fish are handled less, it is more cost effective, and the roe in the female capelin is highly nutritious to the animals.

After the fish is taken from the catch vessel, it should go right to the packaging line. Plant managers should have coordinated line process personnel to begin as soon as the fish is ready. Night crews should be used if necessary.

If you are buying from a broker, he should be able to provide answers to the methods used for the specific species you are buying. Remember though, brokers typically are not present at the plants during production. I have found that when I time my sanitary inspection of the plant with the actual processing of my product, the overall quality control is improved. I know I am receiving the best product that has been handled properly and frozen to my specifications in the shortest period of time.

Our standards of quality for the fish we feed the animals we are entrusted with should always be the highest possible. And this does not necessarily equate to an increase in costs. I have found that by sourcing my own product and controlling as many of the variables as possible, I not only ensure a higher quality of fish, but I can do it at considerable cost savings.

In future issues, I will look at freezing and packaging options, harvest times to optimize desired nutritional values, various analysis to determine levels of decomposition, and touch on fisheries regulations that have recently been passed or are being considered that may have an impact on availability. If you know of pending legislation in your area that will affect supply, or if you have "fishues" of your own, let me know and I will include them in the column.